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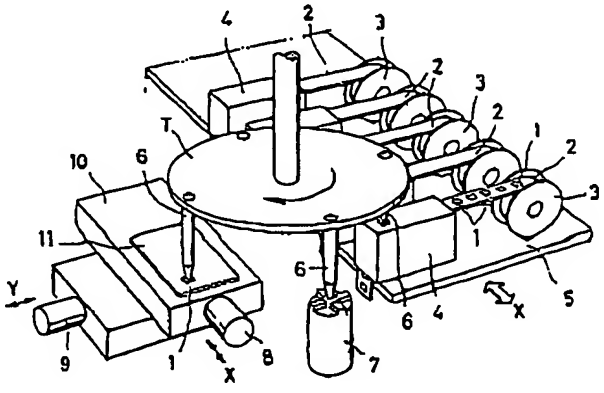
(54) Automatic electronic parts mounting apparatus.

(57) The invention discloses that when parts are mounted on a single board in a plurality of identical patterns, parts mounting can be efficiently performed by changing the sequence of mounting the parts for each pattern in accordance with the arrangement state of the pattern, and a blank portion on the board can be minimized and hence patterning can be effectively performed by arbitrarily setting the directions of the mounting patterns to be mounted on the printed board in accordance with its form. In addition, the invention discloses that when chip parts are mounted on a board in a plurality of patterns including identical patterns and independent pattern having no correlation therewith, parts mounting can be easily and collectively performed, and when a plurality of types of parts having different shapes and sizes are mounted on a board together, a group of parts which are less subject to a positional error due to the movement speed of an X-Y table are repeatedly mounted first on the board at a high movement speed, and a group of parts which are subject to a positional error are repeatedly mounted in the same manner at a low movement speed, thereby preventing a positional error due to an inertial force upon high-speed movement of the X-Y table.

FIG. 1



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AUTOMATIC ELECTRONIC PARTS MOUNTING APPARATUS

Background of the Invention

1. Field of the Invention

The present invention relates to an automatic electronic parts mounting apparatus and, more particularly, to an automatic electronic parts mounting apparatus in which when various chip type electronic parts (to be referred to as chip parts hereinafter), e.g., resistors, capacitors, and transistors are automatically positioned/mounted on a printed board placed on an X-Y table in a plurality of different types of patterns constituted by identical patterns and independent patterns having no correlation therewith chip parts having different shapes and sizes can be selectively positioned/mounted by sorting them in accordance with their forms.

2. Description of the Prior Art

In a conventional automatic electronic parts mounting apparatus of this type, as disclosed in, e.g., U.S. Patent 4,653,664, chip parts having different shapes and sizes are selectively fed from a parts feed means in which they are stored in parts storage tapes wound around the respective tape reels in accordance with their forms and types, the fed chip parts are chucked by a plurality of suction nozzles, which are formed on the periphery of a rotary type index table, at predetermined suction positions, the index table is intermittently rotated so as to convey the chip parts to corresponding parts mounting positions on a printed board placed on an X-Y table, and the chip parts are automatically positioned/mounted at predetermined mounting positions on the printed board by moving the X-Y table in the X-Y directions. Apparatuses having such an arrangement have been developed and put into practical use.

An operation of such a conventional mounting apparatus is generally controlled by programs. In addition, in the above apparatus, when chip parts are mounted on a single printed board in a plurality of identical patterns by repeating the same pattern, and the same mounting operation is repeated in accordance with the same pattern formation direction.

For this reason, in the identical mounting patterns formed on the single printed board, the final parts mounting position of a given pattern and the initial mounting position of the next pattern may be greatly separated, and hence a considerably long period of time is required to move the X-Y table. In addition, since all the patterns formed on the printed board are oriented in the same direction, forming the patterns on the printed board is uniformly limited, and efficient patterning becomes impossible. Therefore, a large portion of a board material is wasted.

Recently, as various types of mounting patterns are produced in small quantities, various patterns tend to be formed in a single printed board. When a plurality of identical patterns and independent patterns having no correlation therewith are formed in a printed board by mounting various chip parts having different shapes and sizes together in this manner, since the above-described process in which the same pattern is repeatedly formed cannot be used, the identical patterns and the independent patterns are sorted, and positioning/mounting must be independently performed in units of sorted patterns, thereby extremely complicating the process.

In addition, when chip parts having different shapes and sizes are to be mounted on a single printed board together, if a large chip part or a chip part with a high center of gravity is mounted first, a positional error due to an inertial force tends occur because the frequency of movement of such a chip part upon high-speed movement of the X-Y table is higher than that of a small chip part or a chip part with a low center of gravity to be mounted next.

3. Summary of the Invention

The present invention has been made to eliminate the drawbacks of the above-described conventional automatic electronic parts mounting apparatus. It is an object of present invention to efficiently perform parts mounting by changing the parts mounting sequence for each mounting pattern in accordance with the formation state of a mounting pattern. In order to achieve this object, according to the present invention, there is provided an automatic electronic parts mounting apparatus for mounting chip parts having different shapes and sizes repeatedly in a plurality of identical mounting patterns on a single printed board placed on an X-Y table which is moved at high speed in the X-Y directions, comprising a pattern storage means for storing NC (Numerical Control) data of the mounting patterns, a pattern position storage section for storing data representing positions on the board where the mounting patterns

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based on the NC data stored in the pattern storage means are formed, a sequence designating means, arranged in correspondence with the pattern position storage means, for designating a mounting sequence of the chip parts for the mounting patterns, a positioning unit for adjusting a positional relationship between a predetermined position and the chip part by moving the X-Y table at high speed when the chip part designated by the sequence designating means is mounted at the predetermined position on the board, and control means for controlling the positioning unit so as to mount the chip parts corresponding to the mounting patterns stored in the pattern storage section at predetermined positions stored in the pattern storage means in the sequence designated by the sequence designating means.

It is another object of the present invention to efficiently form a pattern on a board and eliminate waste of a board material by causing the pattern position storage means to store data representing a direction in which a mounting pattern based on the NC data is formed on the board.

It is still another object of the present invention to perform positioning/mounting without sorting the identical and independent patterns so as to increase the process speed by a simple, collective parts mounting process. In sequence to achieve this object, according to the present invention, there is provided an automatic electronic parts mounting apparatus for mounting chip parts having different shapes and sizes repeatedly in a plurality of patterns including identical mounting patterns and independent patterns having ano correlation therewith on a single printed board placed on an X-Y table which is moved at high speed in the X-Y directions, comprising a pattern storage means for storing NC data of both the identical and independent mounting patterns, a pattern position storage means for storing data representing positions and directions on the board in accordance with which both the identical and independent mounting patterns based on the NC data stored in the pattern storage means are formed, a sequence designating means, arranged in correspondence with the pattern position storage means, for designating a mounting sequence of the chip parts for both the identical and independent mounting patterns, a positioning unit for adjusting a positional relationship between a predetermined position and the chip part by moving the X-Y table at high speed when the chip part designated by the sequence designating means is mounted at the predetermined position on the board, and control means for controlling the positioning unit so as to mount the chip parts corresponding to both the identical and independent mounting patterns stored in the pattern storage means at predetermined positions stored in the pattern storage means in the sequence designated by the sequence designating means.

It is still another object of the present invention to prevent a positional error of a chip part due to an inertial force upon high-speed movement of the X-Y table and increase precision in mounting the chip parts by sorting/designating the chip parts as groups by the sequence designating means in a mounting sequence in which a positional error due to high-speed movement of the X-Y table is relatively smaller.

4. Brief Description of the Drawings

Fig. 1 is a schematic perspective view showing an overall arrangement of an automatic electronic parts mounting apparatus according to an embodiment of the present invention;

Fig. 2 is a block diagram showing a control section of the apparatus in Fig. 1;

Fig. 3 is a view illustrating a set state of NC data in the apparatus in Fig. 1;

Fig. 4 is a flow chart showing a sequence of control for mounting chip parts in the apparatus in Fig; 1.

Fig. 5 is a view illustrating a mounting state of chip parts on a printed board and a mounting sequence in the apparatus in Fig. 1 according to a first embodiment;

Fig. 6 is a view illustrating an example of setting NC data in the apparatus in Fig. 1 according to the first embodiment;

Fig. 7 is a view illustrating a mounting state of chip parts on a printed board and a mounting sequence in the apparatus in Fig. 1 according to a second embodiment;

Fig. 8 is a view illustrating an example of setting NC data in the apparatus in Fig. 1 according to the second embodiment;

Fig. 9 is a view illustrating a mounting state of chip parts on a printed board and a mounting sequence in the apparatus in Fig. 1 according to a third embodiment;

Fig. 10 is a view illustrating an example of setting NC data in the apparatus in Fig. 1 according to the third embodiment;

Fig. 11 is a view illustrating a mounting state of chip parts on a printed board and a mounting sequence in the apparatus in Fig. 1 according to a fourth embodiment;

Fig. 12 is a view illustrating an example of setting NC data in the apparatus in Fig. 1 according to the fourth embodiment;

Fig. 13 is a view illustrating a mounting state of chip parts on a printed board and a mounting sequence in the apparatus in Fig. 1 according to a fifth embodiment;

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Fig. 14 is a view illustrating an example of setting NC data in the apparatus in Fig. 1 according to the fifth embodiment;

Fig. 15 is a schematic plan view showing a mounting state of electronic parts on a printed board according to another embodiment of the present invention; and

Fig. 16 is a view illustrating an example of setting NC data in the apparatus in Fig. 1 according to a sixth embodiment.

Fig. 17 is a schematic plan view showing a mounting state of electronic parts on a printed board according to furthermore another embodiment of the present invention.

Fig. 18 is a view illustrating a set state of NC data when chip parts are mounted on a printed board in a mounting sequence as shown in Fig. 17.

5. Detailed Description of the Preferred Embodiments

A parts feeding unit according to embodiments of the present invention will be described in detail below with reference to the accompanying drawings.

Fig. 1 is a perspective view showing an overall arrangement of an automatic electronic parts mounting apparatus according to the present invention. Reference numerals 1 denote chip parts which are stored in electronic parts storage tapes 2 at regular spaces. The electronic parts storage tapes 2 are wound around corresponding tape reels 3. The electronic parts storage tapes 2 are fed by a pitch from the tape reels 3 through convey units 4. The tape reels 3 and the convey units 4 are arranged on a tape moving table 5 which moves reciprocatively in the direction of X so as to constitute a parts feed means.

Refering to Fig. 1 reference symbol T denotes a turntable which is intermittently rotatable. Reference numerals 6 denotes suction nozzles arranged on the turntable T. Each suction nozzle 6 chucks one of the chip parts 1 from a corresponding electronic parts storage tape 2 selected in accordance with the moving state of the tape moving table 5 and conveys it onto a printed board placed on an X-Y table (to be described later) upon rotation of the turntable T.

In addition, reference numeral 7 denotes a positioning unit for correcting a positional error of the chip part 1 chucked by each suction nozzle in the X-Y directions and also for setting a mounting angle of the chip part; and 8 and 9, pulse motors for horizontally moving an X-Y table 10, on which a printed board 11 is placed, in the X-Y directions.

More specifically, after the chucked state of the chip part 1 chucked by the suction nozzle 6 is corrected by the positioning unit 7 and also the mounting angle is set, the chip part is conveyed above the X-Y table 10 upon intermittent rotation of the turntable T, and is mounted on the printed board 11 placed on the X-Y table 10. In addition, the mounting position of the chip part 1 to be mounted on the board 11 is adjusted by the horizontal movement of the X-Y table 10. Further, it may be possible that the angle setting of the chip part 1 is performed by rotating the suction nozzle 6 itself chucking the chip part 1, which is not shown in the drawings.

Fig. 2 is a block diagram showing a control means of such an electronic part mounting apparatus. Reference numeral 12 denotes a parts feed driving means for moving the tape moving table 5 and driving the convey units 4; 13, a driving means for driving the pulse motors 8 and 9 of the X-Y table 10; 14, a positioning unit driving means for driving the positioning unit 7; 15, a nozzle driving means for controlling the intermittent rotation of the turntable T and suction operations of the suction nozzles 6; 16, a board convey means for setting/discharging the printed board 11 on/from the X-Y table 10; and 17, an external terminal for connecting a personal computer, a keyboard serving as an input unit for entering various data, or the like. The parts feed driving means 12 and the external terminal 17 are controlled by a central processing unit (to be referred to as a CPU hereinafter) 18.

In addition, reference numeral 19 denotes a memory means connected to the CPU 18. As shown in Fig. 3, the memory means 19 stores NC data consisting of mount data provided as parts mounting data such as step numbers, X-and Y-coordinates of parts mounting positions, mounting directions of chip parts, and types of parts, and offset data representing a position and a direction on a printed board at/in which a pattern is formed, and the parts mounting sequence of the pattern.

In this case, reference symbol F denotes the end of mount data of a repetitive pattern; P, a forward sequence in which the chip parts 1 are mounted in sequence on the board in the forward direction, Q, a reverse sequence in which the parts 1 are mounted in sequence on the board in the reverse direction, and E, the end of all the data. The memory section 19 comprises a step counter for indicating a designation address of mount data, an offset counter for indicating a designation address of offset data, a reverse sequence flag area in which a reverse sequence flag is set, and an end flag area in which an end flag is set.

An operation of such an electronic parts mounting apparatus will be described below with reference to a flow chart shown in Fig. 4.

After all the flags are reset, the offset counter

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is set to 0. Subsequently, it is checked whether an initial offset command is p (forward sequence). If YES is obtained in this step, the step counter is set to 0, and the reverse sequence flag is cleared. If it is a reverse sequence, the step counter is set to a value obtained by incrementing the step number showing the end of the repetitive pattern (see F) by one, and the reverse sequence flag is set.

In the forward sequence, while the step counter is incremented one by one, parts of corresponding mount data are sequentially mounted at predetermined positions. In the reverse sequence, while the step counter is decremented one by one, parts of corresponding mount data are sequentially mounted at predetermined positions.

Note that one-by-one parts mounting is performed in such a manner that each part represented by parts data is mounted at an X-Y corrdiante position represented by mounting position data of mount data designated by the step counter and in a rotational direction θ represented by mounting direction data by utilizing an X-Y coordinate position and a rotational direction θ of offset data designated by the offset counter as references.

More specifically, the moving table 5 is rotated in accordance with each parts data so as to allow the suction nozzle 6 to selectively chuck the chip part 1, positioning and direction setting of the chip part 1 are performed by the positioning unit 7, and the X-Y table 10 is actuated in accordance with mounting position data so as to move a parts mounting position on the printed board 11 to a position under the suction nozzle 6, thereby mounting the part.

When mounting for one pattern is completed, the content of the next offset command is checked. If it is a forward sequence as in the above case, the step counter is incremented and parts are sequentially mounted. If is a reverse sequence, the step counter is decremented and parts are sequentially mounted.

When the final parts mounting pattern is completed after such a mounting operation is repeatedly performed, an end command (E) is detected and the mount operation is ended.

In such a mounting apparatus, when electronic parts are mounted for two identical patterns on a printed. board in accordance with a forward sequence as shown in, e.g., a first embodiment in Fig. 5, NC data shown in Fig. 6 is used.

In addition, when electronic parts are mounted on a printed board for two identical patterns in accordance with forward and reverse sequences as shown in a second embodiment in Fig. 7, NC data shown in Fig. 8 is used.

Furthermore, when electronic parts are mounted on a printed board for four identical patterns in accordance with three forward sequences and one reverse sequence as shown in a third embodiment in Fig. 9. NC data shown in Fig. 10 is used.

Besides the above-described cases, when some patterns of a plurality of identical mounting patterns are formed by changing mounting directions as shown in, e.g., a fourth embodiment in Fig. 11, a predetermined inclination can be set in NC data by setting direction θ of corresponding offset data at a desired angle for example 90°, as shown in Fig. 12.

Moreover, when the chip parts 1 are mounted on the printed board 11 in a plurality of identical patterns and independent patterns having no correlation therewith as shown in a fifth embodiment in Fig. 13, NC data shown in Fig. 14 is used. In this case, the chip parts 1 are mounted for eight identical patterns in accordance with a forward sequence, and then the chip parts are mounted for two independent patterns which are different from each other.

Note that ①, ②, ③, ... in Figs. 5, 7, 9, 11, and 13 represent the sequence of steps.

Fig. 15 shows another embodiment of present invention. In this embodiment, the chip parts 1 are classified into three groups in accordance with their shapes and sizes, i.e., a group constituted by square chip parts 1B and cylindrical chip parts 1A, a group constituted by parts each having a relatively high center of gravity, e.g., electrolytic capacitors 1C, and a group constituted by mini-flat packages 1D each having a relatively large size. When the chip parts 1 are sequentially mounted to form four patterns in accordance with the sequence of the groups and a forward sequence, NC data shown in Fig. 16 is used.

In this case, a control command "F" shown in Fig. 4 represents a repetitive pattern, and steps M1 to M7 indicate the contents of a mounting operation on a board 11A in accordance with a fundamental pattern. In addition, "1" prior to "F" represents the first group of divided patterns in repetitive mounting. Similarly, "2" represents the second group, and "F" represents the last group. "/" after "F" represents that the groups represented by "2" and "F" are different from each other. When "/" is not present, the group represented by "F" is included in the group represented by "2". Furthermore, steps M8 to M11 from "F" to "E" are offset values of pattern positions with respect to the first fundamental pattern, which represent that four patterns are formed on the board from M8 to M11. In this case, a control command "p" represents a forward sequence.

When such chip parts are to be mounted, the chip parts are sequentially mounted on the board 11A in units of sorted groups in a sequence in which they are relatively less subject to a positional

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error on the board 11A due to movement of the X-Y table 10. In Fig. 15, ①, ②, and ③ represent the mounting sequence of the parts. In this case, the CPU 18 controls the X-Y table driving section 13 on the basis of data associated with a movement speed which is stored in the memory section 19 such that the movement speed of the X-Y table 10 is increased when the square chip parts 1B and the cylindrical chip parts 1A are mounted, and is decreased when the electrolytic capacitors 1C having relatively high centers of gravity and mini-flat packages 1D having large sizes are mounted. For example, data associated with a speed stored in the memory section 19 are set in units of sorted groups.

In this embodiment, the chip parts are classified into three groups in accordance with their shapes and sizes, and the X-Y table 10 is moved at two speeds. However, the present invention is not limited to this arrangement. The parts may be classified into four groups in accordance with their shapes and sizes, and three or more movement speeds may be set.

The above-described NC data is updated by a keyboard (not shown) or a personal computer connected to the external terminal. Further, after the chip parts were mounted on the printed board 11, the printed board may be cut into pieces in units of patterns or may not be cut into pieces. It is optional selection.

Fig. 17 shows furthermore another embodiment of the present invention. Similarly to the embodiment shown in Fig. 15, the chip parts 1 are classified into three groups in accordance with their shapes and sizes. In this embodiment, a group constituted by square chip parts 1B and cylindrical chip parts 1A is sequentially mounted on the printed board in accordance with a forward sequence, a reverse sequence and a forward sequence in the different direction of 90°. Secondly, a group constituted by electrolytic capacitors 1C is sequentially mounted on the printed board in accordance with a forward sequence, a reverse sequence and a forward sequencer in the different direction of 90°. Finally,the mini-flat packages 1D are sequentially mounted on the printed board in accordance with a forward sequence, a reverse sequence and a forward sequence in the different direction of 90°. In this case, NC data shown in Fig. 18 is used.

Claims

(1) An automatic electronic parts mounting apparatus for mounting chip parts having different shapes and sizes repeatedly in a plurality of identical mounting patterns on a single printed board placed on an X-Y table which is moved at high speed in the X-Y directions, comprising:
a pattern storage means for storing NC data of the mounting patterns;
a pattern position storage means for storing data representing positions on the board where the mounting patterns based on the NC data stored in said pattern storage means are formed;
a sequence designating means, arranged in correspondence with said pattern position storage means, for designating a mounting sequence of the chip parts for the mounting patterns;
an adjusting means for adjusting a positional relationship between a predetermined position and the chip part by moving said X-Y table at high speed when the chip part designated by said sequence designating means is mounted at the predetermined position on said board; and
control means for controlling said adjusting means so as to mount the chip parts corresponding to the mounting patterns stored in said pattern storage means at predetermined positions stored in said pattern position storage means in the sequence designated by said sequence designating means.

(2) An apparatus according to claim 1, wherein said pattern position storage means stores data representing directions in which the mounting patterns based on the NC data are formed.

(3) An apparatus according to claim 1 or 2 wherein the mounting sequence of the chip parts designated by said sequence designating means is set such that the chip parts are sorted and designated as groups in a sequence in which the chip parts are relatively less subject to a positional error due to high-speed movement of said X-Y table.

(4) An automatic electronic parts mounting apparatus for mounting chip parts having different shapes and sizes repeatedly in a plurality of patterns including identical mounting patterns and independent patterns having no correlation therewith on a single printed board placed on an X-Y table which is moved at high speed in the X-Y directions, comprising:
a pattern storage means for storing NC data of both the identical and independent mounting patterns;
a pattern position storage means for storing data representing positions and difections in accordance with which both the identical and independent mounting patterns based on the NC data stored in said pattern storage means are formed;
a sequence designating means, arranged in correspondence with said pattern position storage means, for designating a mounting sequence of the chip parts for both the identical and independent mounting patterns;
an adjusting means for adjusting a positional relationship between a predetermined position and the chip part by moving said X-Y table at high speed

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when the chip part designated by said sequence designating means is mounted at the predetermined position on said board; and

control means for controlling said positioning unit so as to mount the chip parts corresponding to both the identical and independent mounting patterns stored in said pattern position storage means at predetermined positions stored in said pattern storage means in the sequence designated by said sequence designating means.

(5) An apparatus according to claim 4, wherein the mounting sequence of the chip parts designated by said sequence designating means is set such that the chip parts are sorted and designated as groups in a sequence in which the chip parts are relatively less subject to a positional error due to high-speed movement of said X-Y table.

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Nouvellement déposé

FIG.1

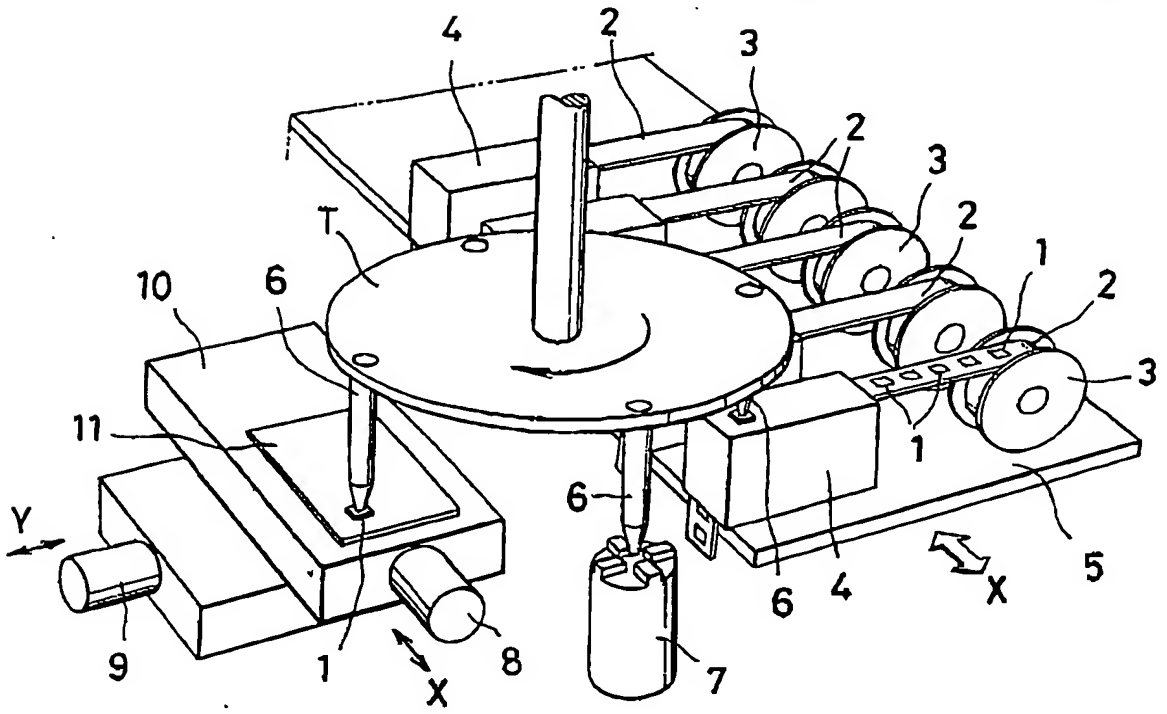
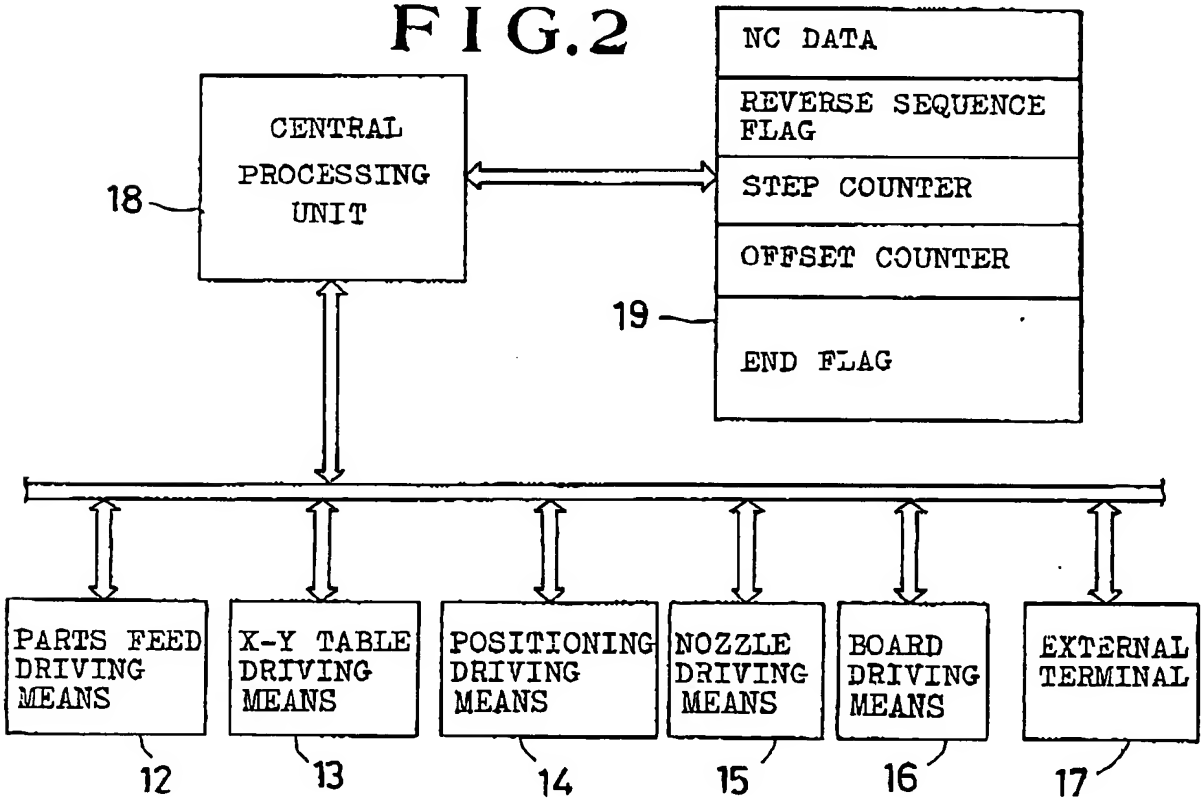


FIG.2



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Nouvellement déposé

FIG.3

STEP NO.	MOUNTING POSITION DATA	MOUNTING DIRECTION DATA	PARTS DATA	CONTROL COMMAND	
				MOUNT DATA	
M001	X0000 Y0000	θ0000	R000		
M123	X0000 Y0000	θ0000	R000	F	
STEP NO	EACH PATTERN OFFSET DATA			CONTROL COMMAND	
				OFFSET DATA	
M124	X0000 Y0000	θ0000		P	
M125	X0000 Y0000	θ0000		Q	
M127	X0000 Y0000	θ0000		P	
				E	

FIG.4

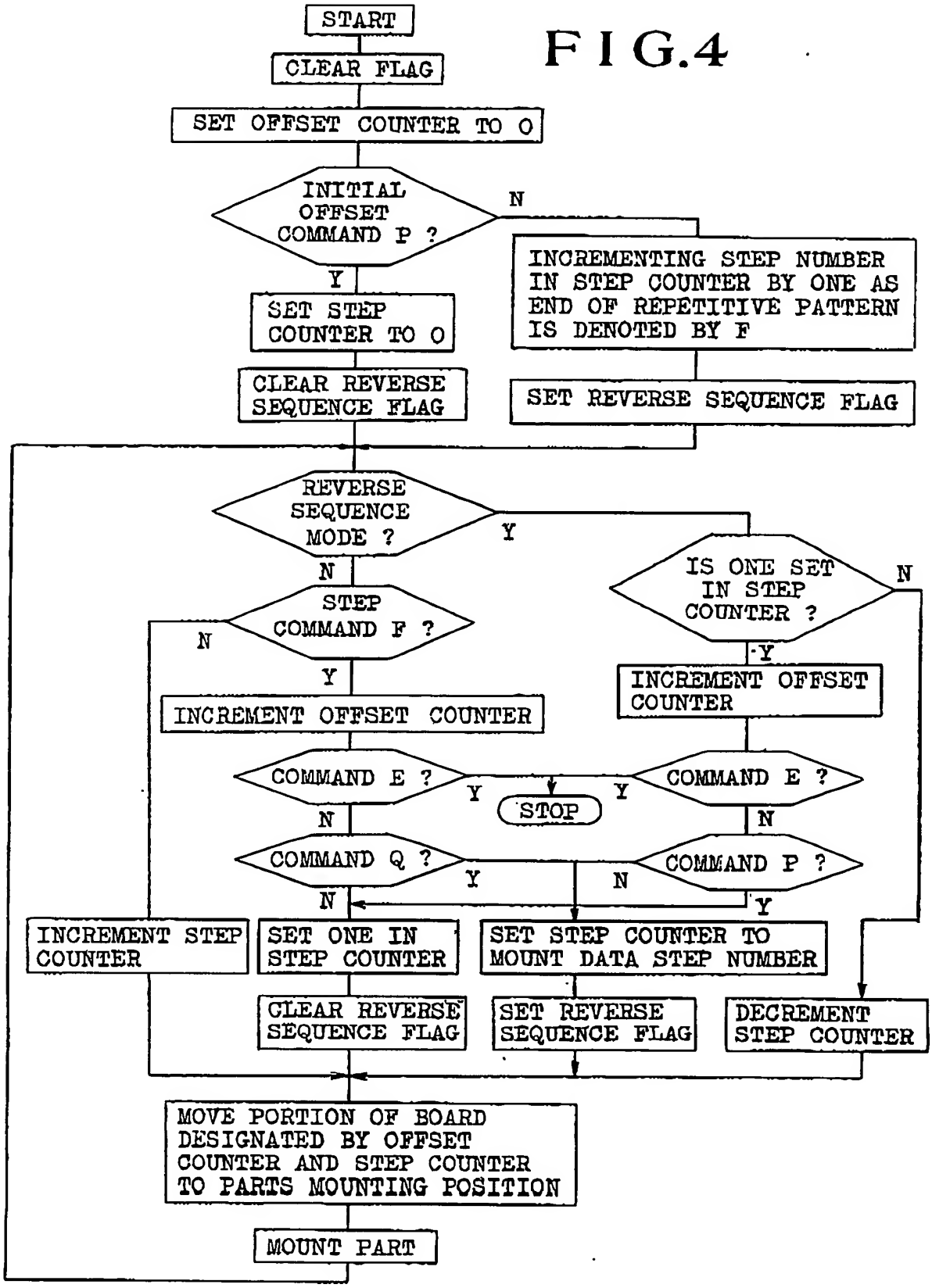
START
CLEAR FLAG
SET OFFSET COUNTER TO 0
INITIAL OFFSET COMMAND P ?
N
Y
INCREMENTING STEP NUMBER IN STEP COUNTER BY ONE AS END OF REPETITIVE PATTERN IS DENOTED BY F
SET STEP COUNTER TO 0
CLEAR REVERSE SEQUENCE FLAG
SET REVERSE SEQUENCE FLAG
REVERSE SEQUENCE MODE ?
Y
N
IS ONE SET IN STEP COUNTER ?
N
Y
STEP COMMAND F ?
N
Y
INCREMENT OFFSET COUNTER
INCREMENT OFFSET COUNTER
COMMAND E ?
Y
STOP
Y
COMMAND E ?
N
N
COMMAND Q ?
Y
N
COMMAND P ?
N
Y
INCREMENT STEP COUNTER
SET ONE IN STEP COUNTER
SET STEP COUNTER TO MOUNT DATA STEP NUMBER
CLEAR REVERSE SEQUENCE FLAG
SET REVERSE SEQUENCE FLAG
DECREMENT STEP COUNTER
MOVE PORTION OF BOARD DESIGNATED BY OFFSET COUNTER AND STEP COUNTER TO PARTS MOUNTING POSITION
MOUNT PART

FIG.5

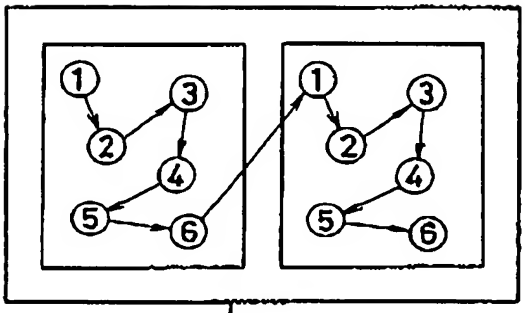

FIG.6

```
M001   X0000   Y0000   0000     R00
 :
M006   X0000   Y0000   0000     R00   F
M007   X0000   Y0000   0000           P
M008   X0000   Y0000   0000           P
                                      E
```

FIG.7

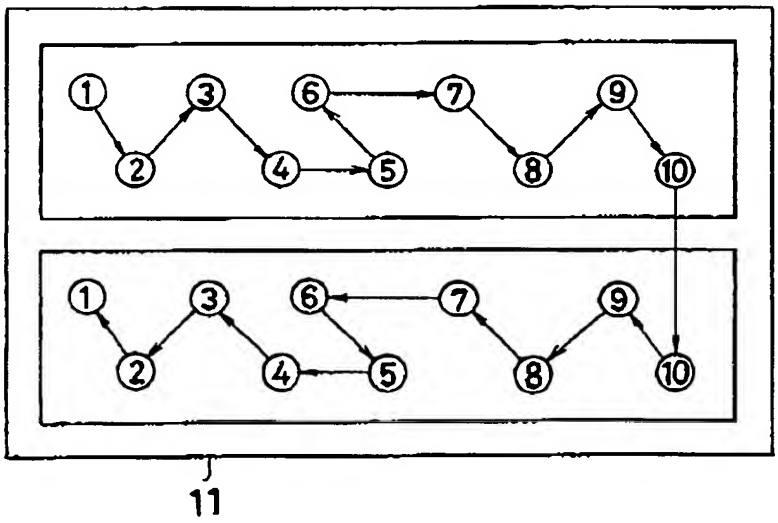

FIG.8

M001	X0000	Y0000	0000	R00	
⋮					
M010	X0000	Y0000	0000	R00	F
M011	X0000	Y0000	0000		P
M012	X0000	Y0000	0000		Q
					E

FIG.9

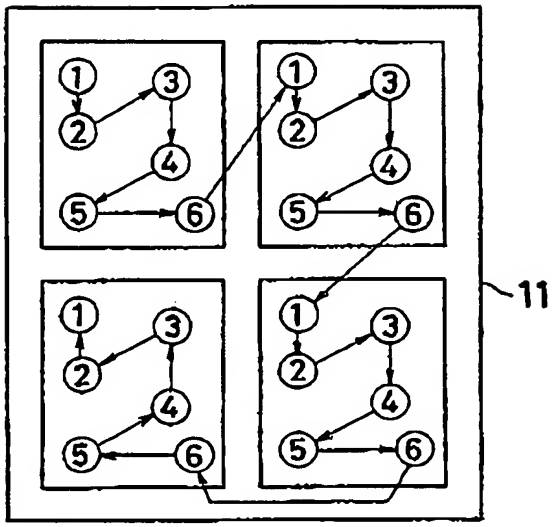

FIG.10

M001	X0000	Y0000	0000	R00	
⋮					
M006	X0000	Y0000	0000	R00	F
M007	X0000	Y0000	0000		P
M008	X0000	Y0000	0000		P
M009	X0000	Y0000	0000		P
M010	X0000	Y0000	0000		Q
					E

FIG.11

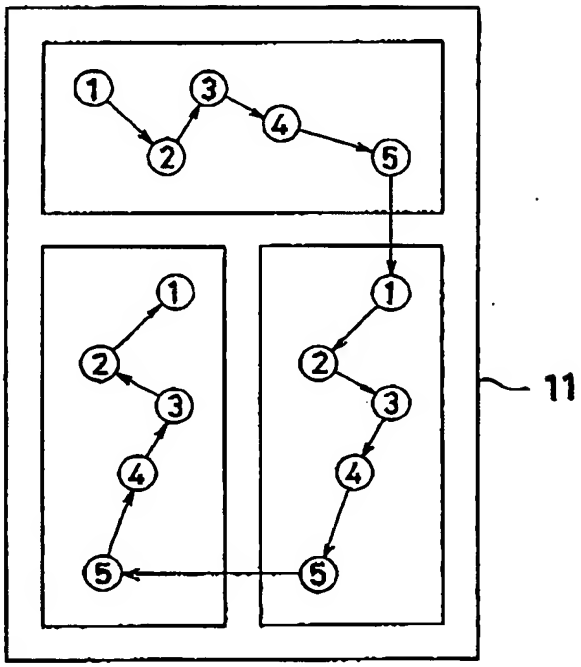

FIG.12

M001	X0000	Y0000	0000	R00	
M005	X0000	Y0000	0000	R00	F
M006	X0000	Y0000	0000		P
M007	X0000	Y0000	0000		P
M008	X0000	Y0000	0000		Q
					E

FIG.13

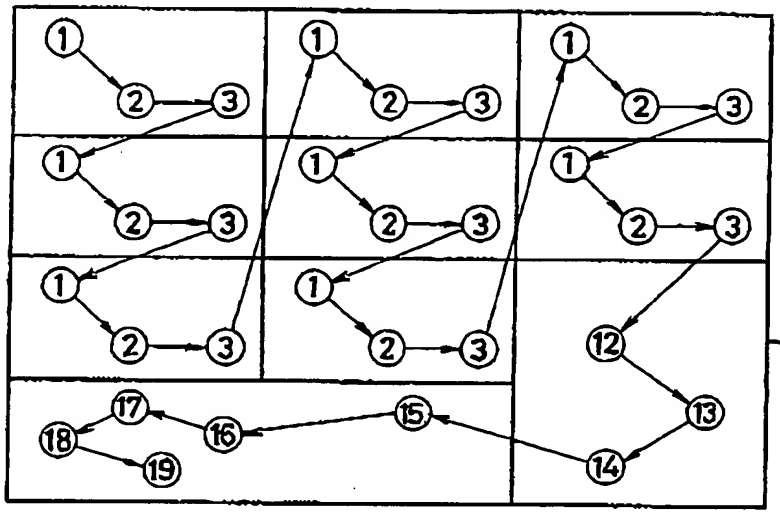

FIG.14

STEP NO.	MOUNTING POSITION DATA	MOUNTING DIRECTION DATA	PARTS DATA	CONTROL COMMAND
M001	X0000 Y0000	θ000	R000	
M002	X0000 Y0000	θ000	R000	
M003	-	-	-	F
M004	-	-	-	P
M005	-	-	-	P
M006	-	-	-	P
M007	-	-	-	P
M008	-	-	-	P
M009	-	-	-	P
M010	-	-	-	P
M011	-	-	-	P
M012	-	-	-	
M013	-	-	-	
M014	-	-	-	
M015	-	-	-	
M016	-	-	-	
M017	-	-	-	
M018	-	-	-	
M019	X0000 Y0000	θ000	R000	
				E

POOR QUALITY

FIG.15

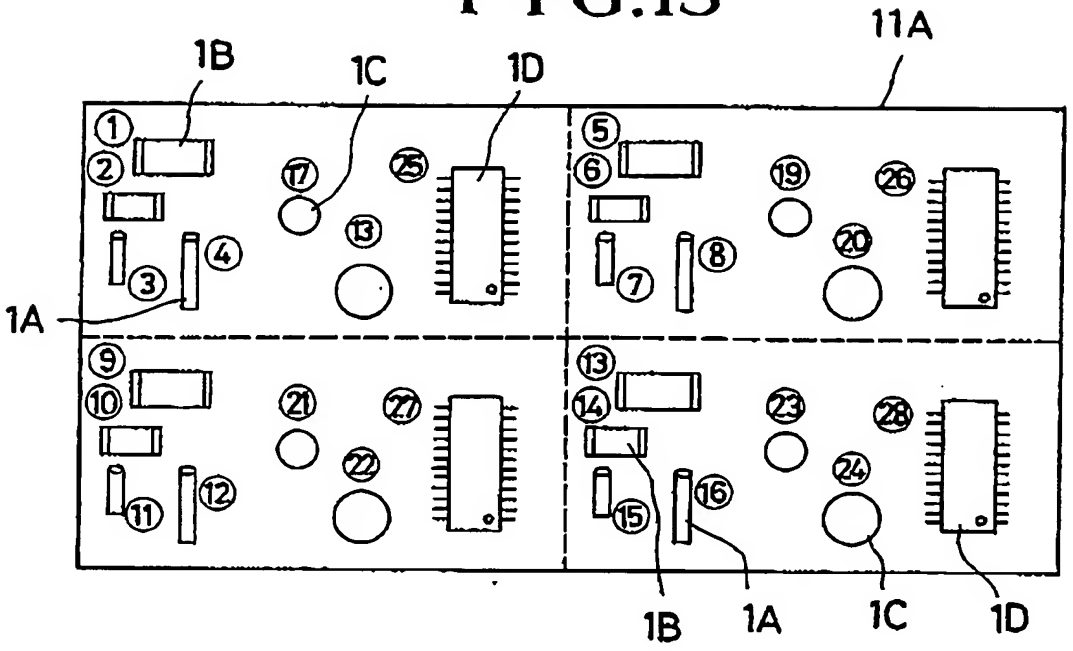

FIG.16

STEP NO.	MOUNTING POSITION DATA	MOUNTING DIRECTION DATA	PARTS DATA	CONTROL COMMAND
M001 M002 M003 M004	X0000 Y0000 X0000 Y0000 - -	0000 0000 - -	R000 R000 - -	 1
M005 M006	- -	- -	- -	 2
M007	-	0000	R000	F/
M008 M009 M010 M011	- - - X0000 Y0000			P P P P
				E

FIG.17

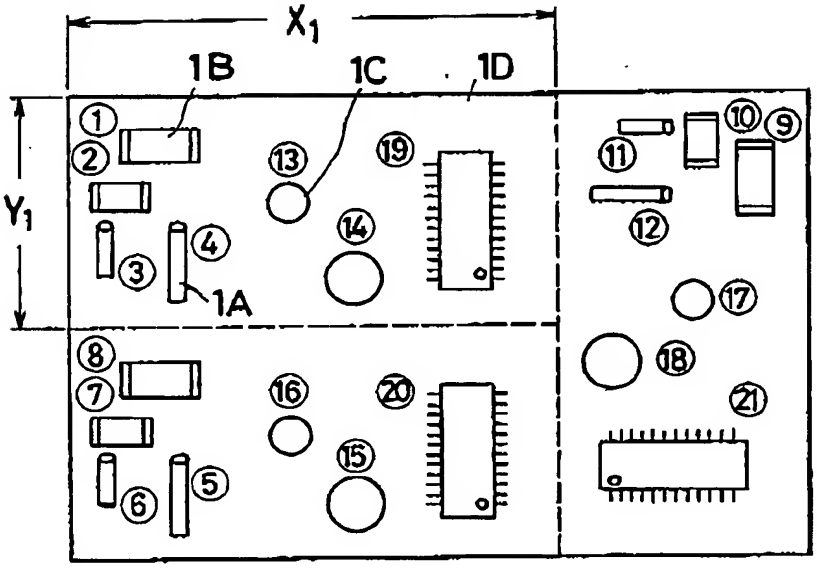

FIG.18

STEP NO.	MOUNTING POSITION DATA	MOUNTING DIRECTION DATA	PARTS DATA	CONTROL COMMAND
M001 M002 M003 M004	X0000 Y0000 X0000 Y0000 X0000 Y0000 - -	0000 0000 0000 -	R000 R000 R000 -	1
M005 M006	- - - -	- -	- -	2
M007	- -	-	-	F/
M008 M009 M010	X0000 Y0000 X0000 Y [Y1] X [X1] Y0000	0000 0000 0090	R000 R000 R000	P Q P
				E

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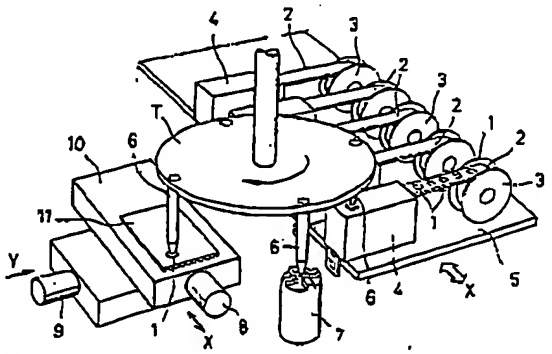
(54) Automatic electronic parts mounting apparatus.

(57) The invention discloses that when parts are mounted on a single board in a plurality of identical patterns, parts mounting can be efficiently performed by changing the sequence of mounting the parts for each pattern in accordance with the arrangement state of the pattern, and a blank portion on the board can be minimized and hence patterning can be effectively performed by arbitrarily setting the directions of the mounting patterns to be mounted on the printed board in accordance with its form. In addition, the invention discloses that when chip parts are mounted on a board in a plurality of patterns including identical patterns and independent pattern having no correlation therewith, parts mounting can be easily and collectively performed, and when a plurality of types of parts having different shapes and sizes are mounted on a board together, a group of parts which are less subject to a positional error due to the movement speed of an X-Y table are repeatedly mounted first on the board at a high movement speed, and a group of parts which are subject to a positional error are repeatedly mounted in the same manner at a low movement speed, thereby preventing a positional error due to an inertial force upon high-speed movement of the X-Y table.

FIG.1



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